The Open University

S103 Discovering science

Course Guide

Contents

Read Part I of this guide BEFORE you read any other course material. It provides the basic information that you need before you begin studying Block 1.

Printed in the United Kingdom

SUP 94609 1
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Part I

1 *Discovering science* starts here!

Embarking on a new course has similarities to starting a new job, moving to a new house or going on holiday. All of them may be accompanied by mixed feelings: excitement and anticipation on the one hand, apprehension and fear of the unknown on the other. Which of these dominates is very dependent on the type of person you are. However, whatever your feelings are as you start 'discovering science', you'll soon adapt to the demands that studying with The Open University makes on you. You'll meet lots of fascinating aspects of science, and all kinds of natural phenomena will be revealed in a new light. What's more, you'll develop a wide range of skills that will be invaluable not only when you are studying but also in other aspects of your life.

So, welcome to *Discovering science*. We're sure that you will find the course adds interest and challenges to your life over the coming year!

1.1 The role of Block 1, *Water for life*

A major aim of the team who produced *Discovering science* was to produce a course that was accessible to as wide a range of students as possible. This range includes people who have no formal educational qualifications, people with some school qualifications (although these may have been obtained a long time ago), and people who have had some form of higher education already. Some S103 students will have done hardly any science or maths before, while a few may have done a great deal. There will be people who want to study science because it will be useful for their job, people who want to study because it will help them get a job or change jobs, and people who are keen to study science purely because they already find it fascinating. For most students, this will be their first encounter with distance learning with The Open University (OU), although some may have already studied one (or more) OU course(s).

With such a varied intake, it is important to ensure that early on all students acquire some basic skills necessary for studying science (if they don't have them already). This is the main role of Block 1, the first of the 12 blocks into which the course is divided. It will allow you to develop or brush up your maths skills, including how to use a scientific calculator, to develop skills associated with using graphs and tables of data, and to develop your communication skills. Just as important, it will help you develop strategies for planning and organizing your study, and for getting the most out of the course material.

Where you concentrate your main efforts while studying Block 1 will depend on your current strengths and weaknesses. You may have left school with a dislike of mathematics and with no maths qualifications; if so, you may need to put quite a lot of effort into working through the maths and calculator sections. But, if you have already done a lot of maths and are skilled at using a scientific calculator, you can read through those sections quite quickly and try a couple of questions to check your understanding. However, although you may be pretty competent at maths, you may not be so good when it comes to written communication; if that is the case, you'll need to study the sections on communication quite carefully. If this is your first OU course, you will need to spend a fair amount of time planning how to organize your time and your study materials, and trying out different strategies for learning from the various course materials. We've provided a range of activities that will help you with this.

Block 1 will make sure that you are 'fit' and properly prepared to benefit fully from the rest of the course. You'll then be able to appreciate more fully the wonders of science that we have in store – a huge variety of topics, from genetics and evolution to volcanoes and earthquakes, and from chemical reactions and drugs to quarks and the Big Bang that started the Universe.

1.2 Items that you need to provide

Besides the learning materials that we mail to you during the year, you will need a range of other items and equipment to study *Discovering science*, including:

- a computer with a DVD-ROM drive for studying the multimedia activities;
- a television and a DVD player for the television programmes (alternatively, these can be viewed on your computer);
- a scientific calculator (see Section 1.5 of this guide for details);
- the set book, *The Sciences Good Study Guide* by Andrew Northedge, Jeff Thomas, Andrew Lane and Alice Peasgood, 1997, The Open University, ISBN 0 7492 3411 3 (see Section 4.11): if you have not already done so, you should buy a copy of this book from a bookshop as soon as you can, because you will be referred to it at the end of your study of Block 1;
- a large ring binder/file (we provide a ring binder in which you can keep the loose-leaf material for the block that you are studying, but you will need a larger binder to store the material for the blocks that you have studied; alternatively, you may find a few smaller binders, or box files, more convenient) (see Section 4.3).

Besides the small kit of items that we provide for practical work activities, there are several items of equipment that you need to supply (see Section 4.5).

1.3 Where do I begin?

As you study *Discovering science* you will use a variety of teaching materials. You'll soon find out what each type is used for, but here we shall tell you enough to get you started.

The course is divided into blocks of study material, each of which is expected to take between two and four weeks to study. With this Course Guide you will have received the materials for the first three blocks of the course; all of the items are listed on the *Contents Checklist*, and you should check that you have received them all. We recommend that you divide this material into two piles, as indicated by the two columns in Table 1 (overleaf). In addition to the items listed, there will be a *Stop Press*, which you should read now because it will contain urgent information relevant to the course materials, and various other minor items. The materials listed in the second column of Table 1 can be put to one side; you will not need these until you have completed studying the first set of material.

You are about to study Block 1, entitled *Water for life*, and for this you need the materials listed in the first column of Table 1. **The essential point that you need to know after reading this Course Guide is that you should begin your study by reading the *Study Guide for Block 1*. From there, everything is well signposted.**

The Study Guide also provides a study plan for Block 1, indicating when you should use the different components. It is printed on card so you can use it as a bookmark and thus refer to it easily while studying Book 1. You can then use it as a file divider when you transfer your Block 1 Study File material from the

Table 1 Course material in the first mailing.

Materials required for Block 1	Materials not required until you have completed Block 1
Course Guide	Block 2, *A temperate Earth?*
Block 1, *Water for life*	Study Guide for Block 2
Study Guide for Block 1	Study File for Block 2
Study File for Block 1	Block 3, *The Earth and its place in the Universe*
Study File ring binder	Study Guide for Block 3
Assessment Booklet 1	*Study File for Block 3*
DVD 1	Course Glossary
Study Calendar	The Earth's surface map
	Notes for TV programmes
	DVD TV programmes

limited space in your ring binder to a larger storage file as you progress to Block 2. After reading the *Study Guide for Block 1*, you will begin studying Book 1. In the book you will meet 'activities', which are marked with an icon telling you whether you need to write something in your Study File, use a DVD or do some practical work. The notes for these activities are in the *Study File for Block 1*.

The *Study File for Block 1* is in loose-leaf format so that you can insert your responses to the activities at appropriate places between the printed sheets. The ring binder is designed to hold *only* those materials associated with the block that you are currently studying. We have provided comments and additional advice on the activities in a separate 'comments' section, and you should read these after you have completed each activity. The *Study File for Block 1* also contains a list of Objectives; these indicate the learning outcomes for the block; that is, what you should be able to do after you have studied it, and we will ask you to refer to these at the end of the block. The Study File also contains a glossary of terms that are used in Block 1, and this will be a handy source of reference if you want to check on the meaning of scientific terms used in this block. We recommend that you use this glossary while studying Block 1 rather than the *Course Glossary* (the second column of Table 1), as you will be able to locate the relevant terms much more easily.

1.4 How does Block 1 relate to the DVD-ROM material?

You will not need to use a computer during your study of Block 1. However, in the Block 1 section of the DVD there is material that will allow you to practise some of the maths skills met in Block 1 and to develop some new maths skills. You should plan to study this material after completing your study of the block.

1.5 What sort of calculator do I need?

Studying and practising science involve some calculations, and you will certainly need a calculator to help you with this. Calculators are very powerful tools, and they do away with the need for a lot of tedious arithmetic. You may be concerned about your ability to cope with the calculations and to understand the mathematics in a science course like this. However, as long as you understand what is meant by adding, subtracting (or taking away), multiplying and dividing, and can do these operations with whole numbers, you are ready to begin Block 1. We will gradually introduce the mathematics that you need to know, and you will be able to use a calculator to work out the answers to numerical calculations, leaving you to concentrate on understanding the meaning of the mathematics.

You will need to use a calculator in Block 1, so if you don't have one at present it would be worth getting one as soon as possible.

What kind of calculator is most suitable? You will need what is usually described as a basic 'scientific' calculator and, if you don't already have one at home, you'll find that any good stationers or department store will have a selection. Scientific calculators have a number of additional keys besides the usual [+] [−] [×] [÷] and [=] keys. The particular functions or operations that you will need your calculator to perform in this course are listed below. We recommend that you choose a calculator that has these features and as few others as possible. Like many electronic devices – video recorders, CD and DVD players, etc. – some calculators now have a huge range of different functions that most people never use and, unless you are an experienced calculator user, the more complicated models are better avoided. In particular, there is no need to get a calculator that is described as 'programmable' or a 'graphics' calculator that can plot graphs.

You will be expected to draw by hand any graphs that form answers to assignment questions.

Calculator functions required for S103

[+] [−] [×] [÷] [=]

brackets [(] [)]

change sign [+/−]

square root [√]

reciprocal [1/x]

raising a number to a power [x^2] [y^x]

raising the number 10 to any power [EE] (sometimes labelled E or EXP)

pi [π]

trigonometric functions [sin] [cos] [tan]

Don't worry if you don't understand what all of the operations in this list mean; you'll be introduced to them gradually in later blocks. To get you used to working with the calculator, we will provide directions on how to do each type of calculation when it first arises.

1.6 When will I meet my tutor and fellow students?

You will have applied to study S103 in a particular catchment area, probably one fairly close to your home. Your Regional Centre will send you details of your S103 tutor who will be your first point of contact with The Open University. She or he will guide you through your first year of study, will answer any questions you might have about the course and will assess your assignments and provide teaching comments on your work. Your tutor may also run sessions at a local centre on both the science content of the course and the skills being developed (your Regional Centre will advise you about these).

You will also receive details of the first meeting with your tutor. We would encourage you to go and meet your tutor and fellow students; you will receive a lot of valuable support and encouragement from them during the year.

1.7 When should I begin studying?

We have allocated two weeks for you to study Block 1. However, depending on your previous experience of and familiarity with science, maths and computing, you may want to give yourself longer to study Block 1 at a more gentle pace (see the *Study Guide for Block 1*). This will mean starting your study early (i.e. do not delay starting Block 2). Hence, assuming you are reading this before the course start date, we recommend that you work through the first part of Block 1 now, to gauge how much time you think you will need. If you do finish Block 1 early, you can make an early start on Block 2, and get ahead a little.

Note that there is a short assignment associated with Block 1, which you will find in *Assessment Booklet 1*. This will give you practice in answering the styles of assignment question that you will meet early in the course. It will also give you the opportunity to receive feedback on your work from your tutor. No marks are given for this assignment, but it will be obvious from your tutor's comments where you have done well and where some more work might be needed.

We recommend you read Part II of this Course Guide now; however, you may want to just 'get on with it', in which case feel free to begin Block 1 now (start by reading the *Study Guide for Block 1*) and return to the rest of this Course Guide later.

Part II

2 Introduction to Part II

In Part I of this guide, we gave you some basic information about the course, particularly Block 1. This second part of the Course Guide previews the course as a whole and presents additional information that will be useful for reference. As we said previously, Block 1 prepares you for the main part of the course, and this main part of the course begins with Block 2.

By the time you begin Block 2 you should have:

- completed Block 1;
- submitted the assignment that goes with it (TMA 01 in Assessment Booklet 1);
- set up your computer;
- looked at the maths packages in the Block 1 section of the DVD-ROM;
- looked at some parts of *The Sciences Good Study Guide*, as suggested by your answers to Block 1 Activity 7.1.

These materials provide a foundation on which we shall build the rest of the course. *It is important to start Block 2 by the time shown on the S103 Study Calendar* and. if you aren't sure that you can complete your study of Block 1 by this time, contact your tutor to discuss possible strategies for catching up.

3 About the course

Newspapers and television carry a wide range of 'science' stories about global warming, genetic modifications of organisms, new drugs, earthquakes and volcanic eruptions, biodiversity, the discovery of subatomic particles, the search for life in other parts of the Universe, and so on. However, the media rarely provide enough information for readers or viewers without a scientific background to understand the science involved. *Discovering science* enables you to make sense of the science behind the topics mentioned above (and many others), and provides a foundation for subsequent study of science. It is a wide-ranging course that introduces important underlying concepts of science and develops the skills needed to study science successfully. It introduces the different disciplines of biology, chemistry, Earth sciences and physics, and shows the links between them.

As you study *Block 1*, you will explore the importance of water for all forms of life, and start to develop the skills needed for studying science. In *Block 2* you will learn about various factors that control the Earth's surface temperature, and how they might determine ice ages and global warming. This subject requires us to introduce topics from a range of science disciplines, which not only illustrates the interdisciplinary nature of many scientific issues today but also provides a foundation for the science you will learn in later blocks.
The overall theme for the next five blocks is 'taking the world apart'. Starting from the largest known structure – the Universe– the course explores in increasingly fine detail how we can understand scientific phenomena by looking at the properties of the component parts of the Universe. After looking at the galaxies that make up the Universe, we focus in *Block 3* on the Solar System and then on the Earth, exploring its internal structure and the rocks forming its surface. You will discover the great diversity of living organisms in *Block 4*, but recognize that, at the microscopic level, they are all made of tiny cells.

One key to understanding life on Earth is energy, and this vital concept is studied in *Block 5*. Continuing to take the world apart, you will see in *Block 6* how all of the materials around you are composed of about 100 different types of atom, which themselves are made up of still smaller components. The smallest components – quarks and leptons – are the ultimate constituents of matter, and *Block 7* reveals that you, the world around you, and the Universe are made from these constituents.

In the second half of the course, we 'put the world back together', showing how knowledge of the component parts that you have discovered in Blocks 3–7 equips us to explain chemical behaviour, life, the Earth and the cosmos. Understanding atoms means that drugs and plastics can be designed for specific applications, as discussed in *Block 8*, and that we can understand some of the workings of living organisms, which are revealed in *Block 9*. Life in all its forms has had profound effects on the Earth's development over geological time-scales, as can be deduced from the fossil record and the history of the Earth, which is studied in *Block 10*. This leads us even further back in time, to the evolution of the Universe as a whole, and *Block 11* investigates this and the cosmological Big Bang from which the Universe is thought to have evolved.

Finally, *Block 12* addresses the questions 'How did life begin on Earth?' and 'Is there life elsewhere in the Universe?'. We have no definite answers to these questions, but these are areas of active research involving a wide range of science disciplines and, therefore, a suitable place to conclude the course.

The course covers a wide range of topics from many different areas of science. Some of these topics, particularly those covered in the blocks at the beginning and the end of the course, are interdisciplinary and highly topical, and others deliberately set out to present some of the key scientific concepts underpinning the disciplines of biology, chemistry, Earth science and physics. However, even in the blocks that focus on a particular discipline, we emphasize the many links to other areas of science.

By the time you have completed Block 6 you will probably have a clear idea of which aspects of science interest you the most. You may even have decided that you would like to work towards a particular named Honours Degree in science. To help make sure that you have time to study the blocks of S103 that are *most relevant* to your chosen area of study, you will have a choice about which blocks to study later in the course (see Section 5.1).

3.1 Course aims and learning outcomes

The overall *aims* of *Discovering science* are to:

- introduce you to the nature of the disciplines of biology, chemistry, Earth sciences and physics, and the importance of an interdisciplinary approach to the study of science;
- support your development of the skills appropriate for the effective learning of science and to enable you to become an independent learner;
- develop and maintain your interest in, and an enthusiasm for, the study of science through an appreciation of how scientific knowledge develops and some of the major impacts of science on society.

These aims are more formally defined by *general learning outcomes* for the course, which are the things you should be able to do when you have finished the course. The general learning outcomes for *Discovering science* are explained in the Appendix to this Course Guide. The list may appear very daunting but don't let it worry you. In order to fulfil the general learning outcomes, each block of the

course has its own specific *objectives* as well (see the paragraph on Objectives in Section 4.3), which will make more sense to you because they are described in the context of the science you will have studied. In achieving the learning outcomes for each block, you will have automatically achieved the learning outcomes for the course.

3.2 Skills development

One of the key roles for S103 is to enable you to develop a range of skills that are necessary for the successful study of science with The Open University. These include skills related to planning and organizing study, learning effectively, science skills, maths skills and communication skills. They will all be developed progressively throughout the course as you learn the science that is presented. At various points in the books, you are referred to 'activities' which provide opportunities for you to practise the skills that are being developed. These activities are accompanied by detailed notes, comments and advice in the Study File for that particular block. Most of the initial skills development is done through the course materials, but we shall also encourage you to use the set book for the course, *The Sciences Good Study Guide* as a source of additional advice and practice (see Section 4.11).

Science skills

As you study the course materials you will develop a range of 'science skills'. These are skills that are associated with 'doing' science, and some of the most important in this category are those of scientific investigation (Figure 1). You will develop the skills of planning investigations, observing, measuring, analysing data, drawing conclusions and developing and testing hypotheses. Some of this will be done in the context of practical work at home, but many of the DVD-video and multimedia activities will develop these skills too. Two other important science skills are (i) modelling – scientists often attempt to understand their observations of complex situations by referring to more simple, straightforward situations – and (ii) classifying, which scientists use to make sense of the wealth of information in the world around us by grouping objects or observations in terms of their similarities and differences.

Activity 2.1 Measuring precipitation

You should now break off from studying the book in order to start some practical work in which you will set up a simple rain gauge and use it to record precipitation throughout the four weeks allocated to the study of Block 2. This will not only help you to develop practical science skills but also help you to understand the idea of a mean value. It will require only about one hour of your time in total, but spread over the next four weeks. Therefore you should start this practical work as soon as possible. ◀

Figure 1 An example of an activity that develops practical work skills.

Mathematical skills

Maths skills are taught and developed at the points in the text where you need to use them. Block 1 has a heavy emphasis on maths skills. These skills will be developed as the course progresses, and further skills will be introduced when necessary (see Figure 2 for an example). In some blocks, such as Block 5, there will be greater emphasis on *applying* maths skills and solving problems, and these will be developed through structured activities.

Box 6.2 Calculations involving powers of ten

You were introduced to the use of powers of ten for large and small numbers in Block 1, but so far you have not been asked to do any calculations using them.

Suppose we have two numbers expressed in scientific notation, say 3×10^2 and 2×10^2. How do we add, subtract, multiply or divide these numbers?

Boxes 6.1 and 6.2 in Block 1 taught you how to enter powers of ten into your calculator, using the EE key (or the E or EXP key). Thus, an obvious way of carrying out these calculations is to use a calculator. To add 3×10^2 and 2×10^2 you simply use the plus key:

3 EE 2 + 2 EE 2 =

Figure 2 Many of the maths skills will be taught in text boxes.

Communicating science skills

Scientists frequently need to convey scientific ideas in writing, and the course will help you to develop and practise your skills in this area (Figure 3). In the first assignments you have to produce several paragraphs of scientific writing, and you will build up to a longer scientific account later in the course. As well as written communication, we will develop your abilities to express your ideas in diagrams, graphs and tables, and your abilities to read and interpret such information. Where available, sessions at local centres with your tutor and the students whom you meet there will allow the development of oral communication skills, as well as give opportunities for you to work together with other students.

Activity 10.3 Human consequences of a rise in the GMST

This activity is intended to give you practice at planning a longer piece of writing at the same time as reflecting on the different styles of writing that will be developed through *Discovering Science*.

Figure 3 Part of the Study File notes for an activity that develops communication skills.

Effective learning skills

There is a variety of activities that will help you to plan and organize your study time effectively. Also, we shall introduce a range of ways in which you can study actively, including highlighting and note-taking as you read, summarizing sections of text in either words or diagrams, scanning text, producing your own glossary of terms and using the *Course Glossary*. You will also be given advice on how to learn from the non-text materials, particularly DVD-video and multimedia activities. Periodically, we shall ask you to pause and review how your learning is progressing and to reflect on any changes that might make your learning more effective (Figure 4).

Activity 11.1 Reviewing your study of Block 2

(*You should spend at least 15 minutes on this activity*)

This block covers a wide range of different science concepts, drawn from biology, chemistry, Earth science and physics, and many of these concepts will be new to you. Also, it introduces a large number of new scientific terms. In this activity we would like you to reflect on how you have coped with all of the new science that you have studied in Block 2.

(a) First, think about the new terms introduced in the block. Scan through the book index, and note down any bold terms for which you are not sure of the meaning. Now think about occasions while you were studying the block when you came across terms that you were unsure of

- What strategies did you adopt to clarify the meanings of the terms?
- Do you have any strategies for helping you to remember new scientific terms?

Figure 4 Part of the Study File notes for an end-of-block activity.

3.3 Use of your computer

Open University students have a wide variety of backgrounds, so there will be some who have never touched a computer keyboard before and some who spend much of their working (or even leisure) time sitting in front of a computer. Wherever you think you fit in this broad range of backgrounds, we believe that you will soon discover the value of the computer in learning science and in developing study skills.

You will use your computer for several varied purposes while you are studying *Discovering science*.

1 For learning science and developing science-related skills by tackling a variety of DVD-based interactive multimedia activities: there are more than 25 of these activities, and the time required to complete each of them ranges from 30 minutes to 5 hours.
2 To help you to assess how well you have understood the material you have studied: a set of questions (with answers) is provided on DVD for each block of the course, and working through these will reinforce your learning and provide useful feedback to help you with areas where you are having difficulties.
3 For developing maths skills: seven programs are available to help you.
4 To view the video sequences. Note that these can also be viewed using a DVD player attached to a television.
5 For searching the electronic copies of the course books.
6 To access your 'student home' web page, where you can link to many resources. For example, you can keep track of your marks or download electronic versions of the assessment booklets.
7 To participate in a computer conference with other S103 students.

The S103 computer conference

We would encourage you to participate in the computer-based conference for S103. In essence this is simply a remote-access self-help group, which provides a forum for exchanging views about the course and sharing difficulties. The conference is not an essential part of the course but you may find it is a useful supplement to your studies. It will also allow you to send and receive electronic

mail (email). The extent to which the conference is useful and how it is used is up to the participants. Chapter 7, Section 3.4 of *The Sciences Good Study Guide* says a little more about the attractions of computer-based conferences.

Registration and use of the conference are free (i.e. no extra cost over and above those you normally incur in going online). The conference uses *FirstClass* software and can be accessed through web pages.

All students are automatically registered on FirstClass. You can visit your list of computing services at www.open.ac.uk/students where you will be able to change some of your personal details (e.g. the 'first name' that has been allocated to you). You can access FirstClass via the web from this site. You will be able to both read and send messages to the conference via your usual internet browser by going to firstclass.open.ac.uk and logging on to Server 2.

Once you have familiarized yourself with FirstClass on the internet, you may want to install the FirstClass client, a purpose-built software package for accessing conferences that are hosted on FirstClass and, as such, has more features specific to FirstClass than the standard internet browser. Students who expect to make considerable use of the conferencing system may prefer to use this FirstClass client instead of their internet browser. The FirstClass pack is included in your first mailing of course materials. Alternatively, the software can be downloaded from www.open.ac.uk/lts/software/#fclass

The OU Computing Helpdesk

The University offers a telephone Helpdesk service dealing with course-related technical computing queries, to all students currently studying an OU course with a computing element. Their staff can help in getting the course software installed and running on your computer. They can sometimes also help with the basic use of the course software and the interpretation of software errors.

They can also help if you should have problems using your OU Computer Username and associated password to gain access to any of the University's networked computing services.

If you have problems with your course software, please check with the Helpdesk before you return any DVD-ROM as faulty. They may be able to offer a solution without you needing to wait for the disks to be exchanged for new ones.

How to contact the Helpdesk

1 Web: www.open.ac.uk/students/helpdesk

The Helpdesk website contains details of known problems and solutions for many course software packages. Please check the Online Support before contacting the Helpdesk by one of the other methods listed below, to see whether the solution to your problem has already been documented.

2 Telephone: +44 (0) 1908 653972

The Helpdesk can be contacted between the hours of 09.00 and 22.30, seven days a week. Most Bank Holidays are covered from 10.00 to 16.00, assuming there are sufficient staff volunteers, but the Helpdesk will close completely on New Year's Day, Easter Sunday, Christmas Day and Boxing Day. It will also be closed for staff training every Wednesday between 15.00 and 16.00.

3 Email: OU-Computing-Helpdesk@open.ac.uk

When sending an email, please make sure that the Subject field contains your Open University Personal Identifier (which is eight characters long), your current course code if applicable and, if you are contacting us with an issue related to an OU username and/or password, please also include the word **Password** in the subject field of the message.

4 Fax: +44 (0) 1908 652193

Please mark for the attention of the OU Computing Helpdesk.

5 Letter

OU Computing Helpdesk
The Open University
Walton Hall
Milton Keynes MK7 6AA

Notes

When contacting the Helpdesk, whether by telephone or one of the other methods detailed above, please supply your student number (Personal Identifier) and course code, together with the full and exact text of any error messages, etc. that your computer or software has given, if applicable.

When sending a fax or letter, please type your message, or write concisely in a clear and legible hand.

During busy periods your telephone call may be placed in a queue. This does not mean that the staff are not there, just that they are busy with other calls. Please be patient and persistent! Priority is given to telephone queries over other methods of contact, to minimize costs where possible.

4 The course components

Discovering science is divided into 12 blocks of teaching material, as indicated at the top of Figure 5. The lengths of the blocks vary, but all of the blocks use a variety of learning materials. In addition to the blocks there is a range of other course components, which are indicated in Figure 5.

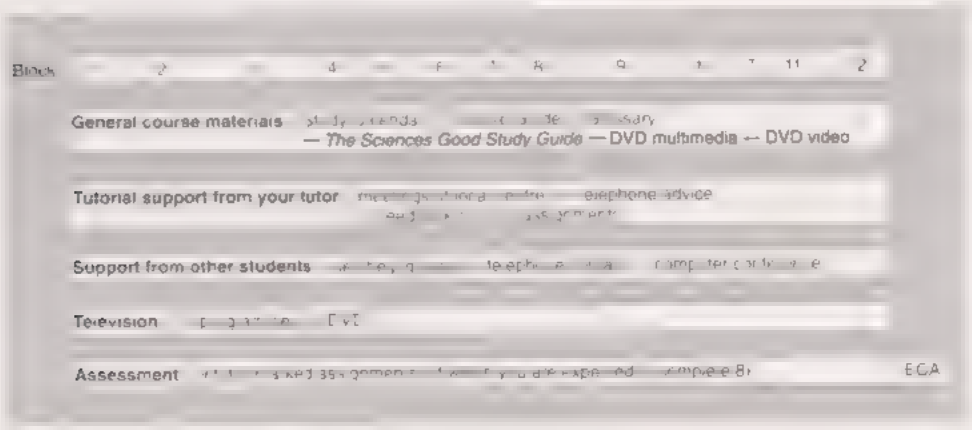

Figure 5 The relationship between the blocks and the other course components. The lengths of the blocks are indicated by the widths of the numbered rectangles. The other course components shown are not related to specific blocks.

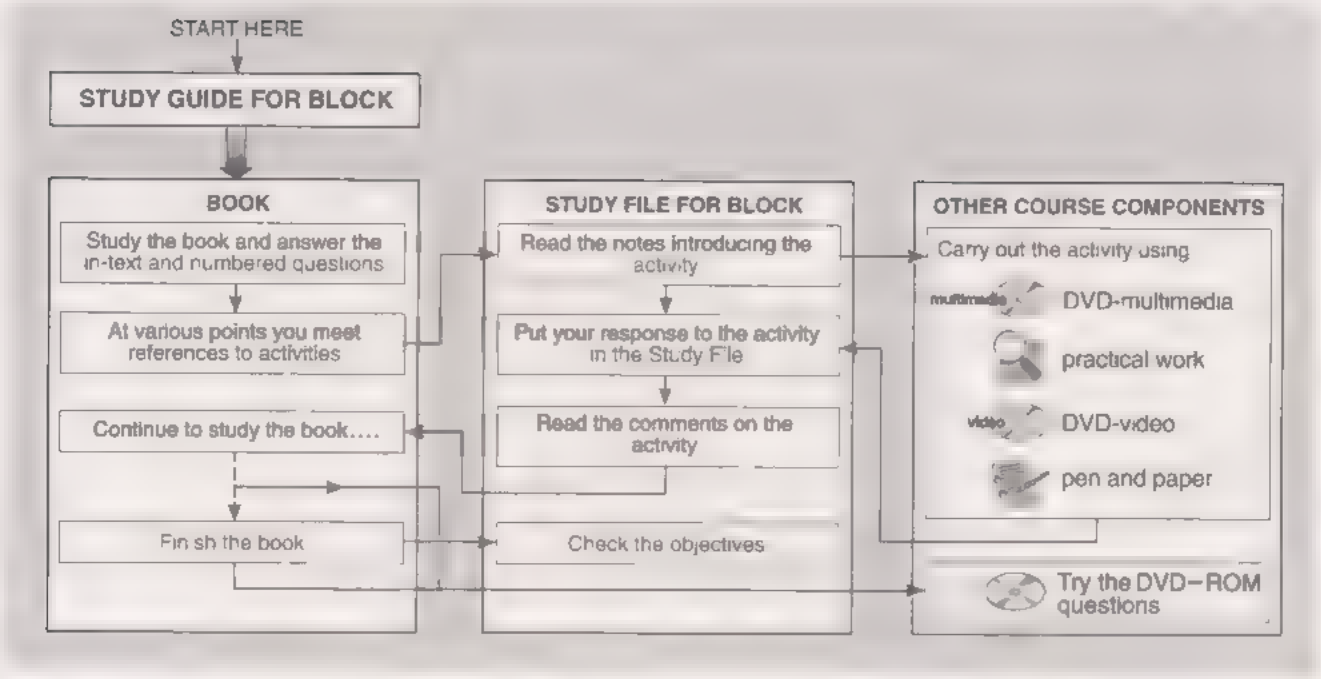

Figure 6 The components of a typical block of *Discovering science* and how they should be studied

Figure 6 shows the various components of a block and how they relate to each other. In the following sections we shall describe in a little more detail the various components of this multimedia course but, although we describe them separately, you should bear in mind that the whole course is designed as an integrated package. The biggest advantage of learning through a multimedia course is that each part of the course can be presented using the most appropriate medium.

4.1 The Study Guides

Studying S103 involves using a range of different learning materials, and we have provided a Study Guide card for each block to help you coordinate the different activities and plan them into your schedule so that you complete them in the appropriate period. On one side of the card there is the Study Guide for the block and, as shown in Figure 6, *reading this should be your starting point in studying each block*. It contains helpful advice on how to study the block and on any additional items that you need to provide for practical work.

On the reverse side of the card there is a study plan for the block, which shows at a glance where the different components (practical work, DVD-video and multimedia activities) fit into the study of the block and estimated times for the different sections and activities. This should be valuable when you are planning and scheduling your study of a block. When developing the course we assumed that students would require a *minimum* of about 10 hours per study week to study directly the course materials listed in the study plan. So, for example, the times in the study plan for Block 2 add up to 40 hours of directed study, because this block is scheduled to take four weeks. *However, the time that you will require for a particular block may be quite different* from this minimum of 10 hours per study week. Feedback from students who completed S103 in previous years suggests that 12 hours per study week would be a realistic *minimum*. How long *you* spend will depend on the nature of the material and on your prior knowledge. There may be blocks, or parts of blocks, that require even less time than our estimated minimum for you to study, perhaps because you have met some of the ideas before or because you find it easy to grasp the kind of material in the block. However, there will be blocks for which the estimates will be too low, and you

will need to spend longer studying that material. In particular, past students have commented that the times *we* estimated for studying the DVD-multimedia activities have been too short.

The times in the study plan do not include non-directed study time that you need for doing multimedia-based questions and assignments, making additional use of the set book, attending sessions at your local centre or meetings of a self-help group, computer conferencing, reflecting on what you have learned and how you have learned it, ongoing revision and consolidation, and various other activities.

We suggest that you use the Study Guide card as a bookmark while studying the block. After completing a block you can use it as a divider when you file away your Study File material (see Section 4.3).

4.2 The books

The main component of the teaching material of each block is the book. There is a book for each block, *apart from Block 12*, and the lengths of the books broadly reflect the number of study weeks that the blocks are allocated. After reading the Study Guide for the block, you will work through the book, departing from it at frequent intervals to tackle various activities (see Figure 6). These activities may involve using the other course components — DVD, practical work kit, etc. These books are also provided electronically on the DVD (as e-books).

The books are intended to be workbooks; don't be afraid to annotate them, to highlight important points, to make notes, comments and reminders in the margins, to write down answers to short questions, and so on. You have probably been through a school system where writing in books was a disciplinary offence, but that was because the school books had to be passed on to another class the following year. Forget all of that — these are *your* books, so you need to use them as effectively as possible. That means adapting them to your use by marking them appropriately.

Questions

The books contain two types of question that are designed to make you think about what you are studying. One type, denoted by grey and blue circles, has the answer immediately after the question. You will, no doubt, be tempted on occasions to read on from question to answer without trying the question. We urge you to resist this temptation; trying to answer each question for yourself is an excellent way of checking that you are following the arguments in the book and reinforcing your learning.

The same advice applies to the numbered questions, although, as the answers to these are at the end of the book, there is less temptation to skip straight from question to answer. The numbered questions are normally slightly longer and a little more demanding than the first type, and for many of them you will need to note down your answer or work out a calculation on a separate piece of paper, which you can then keep in your Study File.

Activities

The activities require you to break off your study of the book and do something, for example, carry out some practical work, watch a DVD-video, work with a DVD-multimedia activity, or write a response in your Study File (see Figure 6). All these activities are an integral part of the course. Whenever possible you should tackle them at the point indicated in the book, since subsequent sections of the book will depend on the earlier activities. However, there will be times when you don't have access to your computer or practical kit when you reach an

activity in the book, and you may then have to continue studying the book and return to the activity as soon as you can. The Study Guides will indicate where it is essential to have done particular activities before reading subsequent sections in the book and recommend strategies for these situations. They will also advise you what to do if you have insufficient time to tackle all of the activities.

Whenever you meet an activity in the book, you should refer to the Study File before beginning it. The Study File contains notes to help you with each activity and also has comments which you should read after attempting the activity (see Figure 6). Most of the activities provide an opportunity to practise skills that are being developed in the course and which may be tested in assignments. You will therefore find it beneficial to keep a record of your work on each activity at the appropriate point in the Study File. The notes for an activity will often indicate the skills that are being developed.

Boxes

These are used where we break off from the main thread of the book at some point in order to:

- introduce a new skill;
- give some important supporting information;
- provide an interesting snippet which reinforces the main story.

Summaries

Each main section of a book ends with a summary of the important points and the skills in that section. This is an outline of the main points that you should remember and the skills that you should be familiar with after studying that section.

Bold terms

In each book the important new terms and concepts are printed in **bold** where they are defined; they also appear in bold in the Index for ease of reference. These are terms that we expect you to be able to explain the meaning of and use correctly, both during your study of the course and at the end of the course. You will find definitions of these terms in the *Course Glossary* (see Section 4.7).

Index

Each book has an index which you should find particularly useful for locating bold terms and boxes.

4.3 The Study Files

Each of the blocks has associated loose-leaf material known as the Study File for the block. We give you a ring binder for storing all of the loose-leaf material associated with the block you are studying at a particular time. We also provide a plastic holder with which you can attach the book that you are currently studying to the ring binder; simply pass the back cover of the book through the slot in the holder, and attach it to the rings.

We recommend that, when you have completed studying a block, you transfer all of the loose-leaf material for it to another ring binder in which you can store Study File material for several blocks, separated by the relevant Study Guide card (see Section 1.2).

Notes and comments on activities

The main components of the Study File are the notes and comments on each activity. These activities are designed to enhance your learning and to develop a wide range of skills. Some involve studying a DVD-video sequence, tackling some practical work, or working with a DVD-multimedia activity, and others are essentially 'pen-and-paper' activities.

Each time that you reach an activity in the book, read the notes for that activity in the Study File (see Figure 6). These give details about the activity and advice on how it should be tackled. After completing the activity, read the comments and further advice that are in the 'Comments' section of the Study File, before resuming your study of the book.

The Study File is loose-leaf so that it is easy to insert the additional sheets of paper that you use for your responses to the activities. It is important that you keep your activity responses filed systematically in this way, so that you can refer back to them easily when doing assignments, later in the course and when you are preparing your end-of-course assessment.

Objectives

A third important component of the Study File for each block is the objectives. These are the learning outcomes for each block, that is, the things that you should be able to do when you have finished studying the block. A summary of the learning outcomes for *the course as a whole* is given in the Appendix to this Course Guide. After each objective there is a list of questions and activities that are related to it. Also, for the objectives that are related to skills, there are references to places in *The Sciences Good Study Guide* (see Section 4.11) where you can find additional help and advice. We recommend that you look carefully at the objectives after studying each block. If you don't feel confident that you have achieved some of them, try the relevant questions and activities again, or consult *The Sciences Good Study Guide*. Many block objectives are revisited in later blocks, so you may find that, if you weren't confident about some of them early in the course, you are by the *end* of the course, and that is what matters.

4.4 The DVD-ROMs

In the first course mailing you received the S103 multimedia DVDs. There are four different types of material on DVD-ROM for you to use with your computer.

Interactive activities for learning science

The main use of the computer is for learning science and developing science-related skills by tackling a variety of interactive multimedia activities. There are 25 of these activities integrated in the blocks, and their estimated study time varies from 30 minutes to 5 hours, although, as we said earlier, these times may be *underestimates*. The book and the Study Guide indicate the best point to study a particular multimedia activity and there are notes and comments in the Study File for each one. The aims of these activities vary widely, but all of them are designed to enhance your learning of particular topics by allowing you to interact with a range of media (video, animations, text, graphics, audio), all under computer control. Learning from DVD activities is very different from learning from printed material, and we shall provide advice in the Study File that will enable you to develop the necessary skills to do this.

DVD-video

We use video to teach various topics that would be difficult to convey on the printed page. You will see volcanic eruptions, scientific experiments and demonstrations, and animations that clarify the dynamic nature of scientific processes. Like studying the printed material, studying these DVD-videos should be an active process, and you will be asked to make observations, measurements and deductions as you watch the videos.

There are 19 DVD-video activities in the course, totalling 5 hours of DVD running time. The book and the Study Guide indicate the best point in a block to study a DVD-video, and there are notes and comments in the Study File for all of the DVD-video activities. These notes include advice on 'how to learn from DVD video', because this is rather different from learning from printed material. The DVD-videos can be viewed either on your computer or on a DVD player attached to your television.

Maths skills software

Discovering science is designed for people from a very wide range of backgrounds. You may already be a competent mathematician but, on the other hand, like many students, you may feel that your maths is shaky. We introduce the maths that you need to know in some of the 'boxed' sections in the S103 books. However, the best way of learning maths is to work through some examples. We have therefore provided on DVD-ROM the following maths skills programs to accompany the first few blocks of the course.

- A set of four programs that reinforce skills developed in Block 1 (for use after you have completed Block 1): Calculator practice; Fractions, decimals, percentages and ratios; Units; Powers and scientific notation.
- Two programs that develop skills required in Block 2 (for use between Block 1 and Block 2): Adding and subtracting negative numbers; Multiplying and dividing negative numbers.
- A program that reinforces skills developed in Block 3 (for use while studying Block 3): Algebraic manipulation.

Time spent developing your maths skills early in the course is time well spent!

Questions

Each of Blocks 2 to 11 has a set of questions on DVD-ROM that you can use to assess for yourself how well you are progressing. The questions use the 'intelligence' of the computer to provide hints when your answers are not correct and to guide you towards the answer. In some cases they will provide feedback that confirms you have achieved certain objectives for the block. But, even more important, they will identify areas where you need to do more work to improve your understanding or skills, and the feedback will direct you to relevant parts of the block or to *The Sciences Good Study Guide*.

There are roughly five questions per study week, and you can tackle these questions in a variety of ways. You may want to do the questions on a section, or a few sections, part way through your study of the block, or you can do the complete set when you have finished the block. You can use the questions again for revision when you return later in the course to concepts that were introduced in earlier blocks.

4.5 Practical work

We provide a small kit of items that you will use for practical work activities. It includes rock specimens for activities in Blocks 3 and 10, casts of fossils for Block 10, a hand lens for examining the rocks and fossils and for examining holly leaves in an activity split between Blocks 4 and 9, a diffraction grating that you will use in Block 7, and a book of indicator papers for tests of acidity that you will do during Block 8.

We shall also ask you to do several experiments that require items or equipment that you may have around the home, or can buy or borrow. The *Practical Work Booklet*, which you will receive with the kit, gives further details of the practical work, the kit, items that you will need to provide yourself, and the safety advice relating to experimental work. The items required for each practical activity are also mentioned in the Study Guide for the relevant block and listed in the Study File notes for the practical work activity.

In addition to this 'hands-on' practical work at home, we provide a range of DVD-video and multimedia activities which develop skills associated with practical work – skills such as observing, measuring, data recording and analysing, and forming and testing a hypothesis.

4.6 S103 *Study Calendar* — what will I study, and when?

The course is divided into 12 blocks of teaching material, and the S103 *Study Calendar* shows the start date for studying each of Blocks 1 to 12. Although you will have a choice about which blocks to study later in the course, we anticipate that everyone will study Block 7 and Block 8. After this, students will probably begin to study Blocks 9 to 11 at slightly different times, so you will need to work out your own study calendar to best suit your choice within the constraints of the cut-off dates given on the S103 *Study Calendar*. It may pay you to submit tutor-marked assignments (TMAs) *earlier* than the cut-off date. For example, if you have decided to concentrate your efforts into Blocks 10 and 11, and to omit Block 9, you should aim to submit TMAs 08 and 09 *earlier* than the cut-off dates shown for these TMAs.

The *Study Calendar* contains vital information about the cut-off dates for submission of your TMAs and when to watch the S103 television programmes. You could pin up this calendar in a convenient place, and you may find it useful to transfer the key dates to your diary. It is very important that you keep to the schedule on this calendar as closely as possible. Block 2 and the subsequent blocks are more intensive than Block 1, and you will need to be careful that you don't fall behind.

4.7 The *Course Glossary*

The *Course Glossary* contains definitions and explanations of the most important terms that are used in the course. It contains all of the terms printed in **bold** type in the course – the terms that you need to remember the meaning of and be able to use correctly – and we have also included some other terms which you might want to refer to. The *Course Glossary* is also provided on DVD-ROM.

The printed and electronic glossaries should be valuable reference documents while you are studying the blocks or tackling assignments. However, a dictionary may also be useful for checking the meaning of words not included in the *Course Glossary*.

4.8 Television programmes

Ten 30-minute television programmes were made for S103, to show science in a rather broader context than in the rest of the course. They take a narrative, documentary approach and weave a variety of aspects – such as historical or social perspectives – into the scientific stories that they tell. They cover a diverse range of topics and most are only loosely connected with the other teaching material in the blocks.

The programmes, originally broadcast twice during the year on BBC 2, are now included on a DVD (sent with the first mailing of course materials) so you can easily watch a programme while studying a particular block.

There are notes for each programme in the S103 *Television Notes* booklet, which you also received in the first mailing, and these indicate any links to relevant blocks. In addition, the Study Guide for a particular block will indicate whether there are any relevant television programmes.

4.9 Tutorial support

Your Regional Centre should already have told you the name of your tutor, who will be responsible for teaching and advising you throughout the course. He or she will mark your assignments and provide feedback on your work, probably run sessions for S103 students at a local centre, help you with any study problems, and generally be available to guide and encourage you as you progress through the course.

Dates and times of any meetings for S103 students at local or regional centres will be sent to you either directly by the Regional Centre or by your tutor, and you may like to write these on your *Study Calendar*. These meetings are usually held regularly throughout the year, and we would strongly encourage you to attend if you can. Your tutor will work with you and a group of perhaps 10 to 15 other students to help your understanding of the science concepts in the course and to develop the wide range of skills that are important both for studying science and more generally. Note that these meetings are not formal 'classroom' situations but informal sessions where your tutor will try to respond to the needs of the student group. Although your tutor is unlikely to be an expert in all of the science disciplines, there will always be help and discussion available for any academic queries you may have, and it can be quite a morale booster to realize that you aren't the only student who is having difficulty with a particular topic. We strongly recommend that you attend tutorials.

Correspondence tuition

All of the assignments that you submit on time will come back with comments and advice. These comments will point out misunderstandings or errors, together with suggestions about how to overcome any problems – and there will also be compliments and congratulations on the parts that you have done well! Your tutor will spend a lot of time writing individual comments on your assignments, and you should aim to make the most of this personalized tuition. Even though you will receive each marked assignment several weeks after you submitted it, and you will have moved on to studying a new block, *you should look carefully at all of the comments and think about how you can act on them.* You will find that many of the comments are designed to help you with future assignments, as well as to sort out any problems with the last one.

4.10 Support from other students

As well as the timetabled local centre sessions, some groups of students arrange to meet regularly on an informal basis as a 'self-help' study group, and such meetings can be extremely beneficial. Even if you find it impossible to attend the local centre sessions, you may be interested in joining a self-help group or just chatting to another student on the telephone. If you contact your tutor, he or she should be able to put you in touch with other students in your area.

The University has its own electronic conferencing system with several online chat-rooms for more informal help and discussion. S103 has its own computer conference that we have set up for students (see Section 3.3). We encourage you to try this because many students find it is a valuable way to develop contacts with other students who are studying the course and to resolve difficulties that they are having.

4.11 *The Sciences Good Study Guide*

We have made *The Sciences Good Study Guide* (*SGSG*) a set book because it complements so well the development of skills in S103. The book contains much useful teaching, advice and help that we think you will find valuable, and is presented in a friendly and accessible fashion. Depending on your background, you may not need to study the complete book but you will certainly benefit from studying large parts of it.

The skills will generally be developed within the course material, and we shall refer you to the set book from specific points in the text and from the skills objectives for reinforcement and practice of these skills. The book covers many topics at more length and in a more leisurely way than S103, and you may find this helpful both during S103 and in subsequent courses. *SGSG* is designed as a reference book, as well as a textbook, and the layout of key points, boxes and tips makes it easy to use in this way. This is particularly true of maths techniques, which are all in the Maths Help section.

Your tutor is likely to refer you to appropriate sections of the book for help with topics that cause you difficulty in assignments, and may also use it in the study sessions at the local centre.

4.12 A complementary residential school course

There is a separate, 10-point, complementary OU residential school course (SXR103 *Practising science*), which is designed to introduce students to practical skills in the laboratory and the field, and to the skills of literature and web-based research. The core of the course is a week spent in the laboratory and field at a host university.

Before attending this residential school, you will be expected to have studied a block of material that teaches the background science for the practical work. Students who are currently studying S103 (or who have passed S103 already) will find that some of this background science is familiar. The course is assessed by satisfactory participation in the residential school's practical activities and other sessions, and by an end-of-course assessment based on the work carried out at the residential school.

The course is optional if you decide that you *don't want to specialize* in a particular area of science, or even in science as a whole. *A pass in SXR103 is compulsory only if you want a named honours degree in science* (i.e. a degree with a title that reflects the science area(s) in which you have specialized).

You can take SXR103 at any stage in your degree studies, but it would be most beneficial to do it before studying residential school courses at higher levels.

You may like to note that students who have done SXR103 almost universally say that it was a really great experience (even though theymay have been in two minds about it before they went). We certainly recommend SXR103 to all students interested in practical science. Registration usually opens in mid-October and closes around mid-June. We advise you to register as early as possible to ensure that you get your preferred choice of week.

4.13 Certificate in Natural Sciences

Successful completion of S103 allows you to claim a Certificate in Natural Sciences. To do this, you simply link S103 to the Certificate in Natural Sciences qualification (code C26) on your student homepage. This can be done before starting S103, during your study of the course, or after completing it. Note that claiming the Certificate in Natural Sciences does *not* affect the way S103 will count towards a degree, and so we encourage all students to claim this qualification.

5 Assessment

Your performance in S103 *Discovering science* is assessed by a combination of tutor-marked assignments (TMAs), which you will complete at intervals throughout the year (continuous assessment), and an end-of-course assessment (ECA), which you *must* submit before the ECA deadline. This system of assessment is designed to give both you and us a fair and reliable method of collecting information about your progress.

- The TMAs encourage you to work through the course at a steady pace, practising skills and exploring concepts as these are introduced in the course. They are a crucial tool for teaching and learning; the feedback you are given on your TMAs will develop your skills and knowledge greatly.
- The ECA assesses your overall skills achievement at the end of the course, and encourages you to use your knowledge and understanding of the science taught in the course to explore a new topic at the end of the course.

Your average continuous assessment score and the score for your ECA each contribute 50% towards your final course score. However, both your *average* TMA score (not each individual TMA score) and your ECA score will need to be at least 40% to guarantee you a pass for the course as a whole. In order to pass the continuous assessment component, you need to achieve an overall score of 40%. You should also note that S103 is a pass/fail course: this means that neither graded passes nor distinction grades are awarded.

However, you are strongly advised to complete *all* of the required assessments and so obtain as high a course mark as you can. The mark will then reflect your true level of achievement and give you the best indication of whether you are ready to proceed to study at Level 2. As a general rule, we believe that students obtaining around 65–70% or higher in S103 are adequately equipped to proceed to Level 2. Students who obtain below this mark may be better served by completing additional Level 1 courses before proceeding to higher level study. If you think this affects you, you should speak to your tutor and or a study adviser in your region.

5.1 Tutor-marked assignments

There are nine TMAs for this course, of which you are expected to complete eight. Each requires you to send your completed work to your tutor, who will give you feedback on the assignment and a mark for your work, with the exception of TMA 01, which is for feedback only.

The first of these assignments is what we call 'formative'. It is designed to give you an opportunity to practise doing a short, relatively easy TMA and to receive constructive feedback from your tutor, without having to worry about the effect your performance will have on your final course score. No mark will be given for this TMA so it will not count towards your continuous assessment score.

The remaining seven TMAs that you should submit are 'summative', i.e. the scores that you receive will count towards your continuous assessment score. You are expected to submit *all four* of TMAs 02–05, although the substitution rule will apply to TMAs 03–05 (see Section 5.3), but you will be able to choose which *three* of TMAs 06–09 to submit. This means that you can omit study of some material in the later part of the course if you wish, allowing you to spend more time on those areas that will best help you to progress with your higher level courses. Your choice will depend on which area(s) of science you have decided to study at higher level. You will be sent advice later in the course to help you make this choice, but you are **strongly advised not to omit TMA 06**. The material that this TMA assesses covers, to a greater or lesser extent, concepts that you will need to rely on at higher levels of study, regardless of which areas of science you choose to study. Note also that if you decide to study all of the material in the later part of the course, and submit *all four* of TMAs 06–09, the *last one you submit will not be accepted* and so will not count towards your continuous assessment score.

Table 2 shows how the TMAs are related to the different blocks in the course and their weighting, i.e. the contribution each of them makes to your overall continuous assessment score. Thus a score of, say, 70% in TMA 02 would contribute 70/100 × 12.5% of your overall continuous assessment score, i.e. 8.75%. However, a score of 70% for TMA 07 would contribute 70/100 × 16.7%, i.e. about 11.7%. TMAs 02–05 have lower weightings than the later TMAs because they are less demanding, reflecting that you are at an early stage in your learning. As you begin to develop the skills that you need to study science effectively, you will find that you can cope with the challenges of the later assignments.

Table 2 How the nine TMAs are distributed throughout the course.

TMA	Block(s) assessed	Approximate weighting
01	1	0% (formative)
02	2	12.5%
03	3	12.5%
04	4 and 5	12.5%
05	6	12.5%
06[a]	Sections 1–6 of 7, and 8	16.7%
07[a]	9	16.7%
08[a]	10	16.7%
09[a]	Sections 7–11 of 7, and 11	16.7%

[a] You will choose *three* of these four TMAs, but we strongly recommend that you include TMA 06 as one of your choices.

The **cut-off date** for each assignment is printed on its first page and is also given on the *Study Calendar*. **This is the date by which the TMA must reach your tutor.** You should always aim to send your TMA so that it arrives before the cut-off date. However, if you are unable to meet this date for any reason, you must contact your tutor *before the cut-off date* to discuss what options are open to you. The standard procedure for late submission is set out in detail in your *Assessment Handbook* and *your tutor will not accept your TMA for grading if you have not followed this procedure*. The maximum extension beyond the published cut-off date that your tutor can permit is one week, and this can be granted only twice throughout the course. Longer extensions are possible *in exceptional circumstances* in consultation with your Regional Office. We strongly recommend that you do your utmost to keep to cut-off dates so you do not lose marks when your TMA is not marked because of late submission, and you do not find yourself pushed for time near the end of the course.

When you send in your TMA, you should attach a partly completed PT3 form. Your tutor will use this to indicate the marks for the TMA and to give a brief summary of your overall achievement of the key skills tested through the TMA, detailed comments about your achievement of the objectives tested will usually be made on the TMA itself. You can expect to receive a TMA back from your tutor, via Walton Hall, between two and three weeks after the cut-off date. By then you will have moved on to studying a new block, but **it is extremely important to look carefully at all of the comments and think about how you can act on them**. Many of the comments will be designed to help you with future assignments, as well as sorting out problems with the last one. Note that your tutor cannot return a TMA *before* a published cut-off date if you decide to submit it early.

5.2 Plagiarism and cheating

You may be wondering whether you should discuss assignment questions with other students. We believe that general discussion is perfectly acceptable, and also desirable, and it is not considered to be cheating. However, you **must** finalize your answers on your own, and you must write out your answer in your own words. *Under no circumstances* should you prepare answers with another student or copy another student's answers. We would regard that as cheating, which is a serious academic offence. We do not, of course, expect you to work on your assignments under 'examination conditions'. You should refer freely to the course material and you may ask your tutor to explain points that you find difficult. However, note that copying or closely paraphrasing passages of your course materials or other sources of material, without the use of quotation marks or acknowledgement of the source of the material, is considered to be plagiarism. The same applies to any information that you may obtain from the internet. Similarly, if you use diagrams or figures in a TMA answer, you should always acknowledge the source. It is also *essential* that you do not post your TMA answers or any TMA questions to any websites or newsgroups on the internet (and this includes selling scripts on eBay), as this too would be considered to be cheating or promoting plagiarism. If you are in any doubt about what constitutes plagiarism, please talk to your tutor, who will advise you.

5.3 The substitution rule

Many OU courses allow 'substitution' to be applied to the marks of one or more TMAs. This system replaces the mark of your lowest scoring TMA with the average of your other scores. In S103 we expect you to submit eight TMAs; however, we do allow the substitution rule to apply on TMAs 03–05 in order to give you a helping hand near the beginning of the course. The substitution procedure works in the following way.

1 The mean (i.e. average) score for all your TMAs is calculated (TMAs you failed to submit count as zero).

2 A 'substitution score' is calculated as the mean of your continuous assessment score plus your ECA score.

3 Your scores for TMAs 03–05 are compared with the substitution score and, if any of these are lower than the substitution score, the score for the *one with the lowest score* (even if this is zero) will be replaced by the substitution score.

4 Your final overall continuous assessment score is then recalculated using the substituted score instead of the TMA score it replaced.

Your *Assessment Handbook* gives an example of the substitution procedure. *The important point to remember is that you should always submit an assignment if you possibly can, even if it is incomplete or not your best work.* Even if you only get 20% for the assignment, your substitution score, and hence your final score, will be higher than if you had not submitted the assignment at all. Submission of the assignment also means that you receive some correspondence tuition and feedback from your tutor.

TMA 02 is *not* substitutable. This is to encourage you as strongly as possible to submit this first summative TMA complete and on time, so your tutor can give you advice that will help you to improve your performance in the later TMAs. The more contact you have with your tutor in the early part of the course, the more successful your study is likely to be. This is also why you are expected to do more TMAs in the first part of the course than in the second part. Note that **substitution happens automatically**, i.e. you do not need to request it.

5.4 The end-of-course assessment (ECA)

At the end of the course, you will do the ECA. This counts as the 'examinable' component of the course, even though you will complete it at home, in your own time, with the aid of your course materials, and not under examination conditions. It will be marked by a different tutor from your own tutor who has marked your TMAs all year.

As this work will be completed under non-examination conditions, you will be asked to sign a statement declaring that it is your own work. You will also be expected to submit *three* copies. One will be sent to your own tutor, who will be asked to verify, as far as it is possible, that the work you have submitted is really yours. By the end of the year, your tutor will have a good idea of the style of your TMA answers.

In certain *exceptional* cases, where you are unable to meet the cut-off date for the ECA because of circumstances beyond your control, you may be eligible to delay your submission until the submission date for the following presentation of S103. Further information will be given in the ECA booklet, which you will receive towards the end of the course.

At this stage, the idea of an ECA might seem somewhat daunting. You may think that, because it is worth 50% of your overall course score, it must be a huge piece of work or else very hard indeed. In fact, it is neither. It is much like doing a TMA and probably won't take any longer either. The first half of the ECA will assess some of the your general scientific skills via some relatively short and straightforward questions, and the second half of the ECA asks you to write a 1000-word account based on the material you study in Block 12. Thus you will almost certainly find the ECA approachable and nothing to be nervous about.

5.5 What to do if things go wrong

Even the best-laid study plans can go awry for reasons beyond your control. For example, personal illness or the illness of a close relative or dependant may mean that you are cannot do your best in a particular TMA or the ECA. The substitution rule (Section 5.3) will help to compensate if just one of TMAs 03–05 is affected. However, what if the ECA is affected, or TMAs 06–09, or even more than one TMA? There are procedures that will allow you to draw your circumstances to the attention of the Examination and Assessment Board at the yearend. These procedures are described in the *End-of-Course Assessment* booklet which you will receive later in the year.

If you find that you are falling behind with your study, it is very important that you **contact your tutor as soon as possible**. Your tutor may be able to give you permission to submit a TMA after the cut-off date, and can give you advice about how to catch up, or what you could miss out without overly prejudicing your chances of passing the course.

6 Further contact details

This guide and your *Student Handbook* (or supplement) are valuable reference documents, which should contain answers to most of the general queries that you might have about studying *Discovering science* with The Open University. They should be the first places to look for information. However, if, after consulting these documents, you still require further information or advice the table opposite tells you whom to contact.

For general advice on how to cope with the Open University system, contact your tutor or Student Services at your Regional Centre. Further helpful information, and the addresses and telephone numbers of various areas of Walton Hall or Regional Centres, are in your *Assessment Handbook* (or supplement). When contacting the University, remember to include your Personal Identifier and the course code.

Problem or subject	Contact
clarification and/or help on any of the course material	your tutor
comments and queries about the subject matter of specific TMAs	your tutor
queries about non-receipt of marked TMAs	first your tutor, then your Regional Office, then write to: Assignment Handling Office The Open University P.O. Box 722 Milton Keynes MK7 6ZT Tel : 01908 655498 Email: assignments@open.ac uk
queries about non-receipt of, incomplete, or damaged, course material, including DVDs extra TMA PT3 forms	write to: The Open University Despatch Services P.O. Box 50 Milton Keynes MK5 8ZL Tel : 01908 233842 Fax: 01908 856611 Email: Distribution-helpdesk@open.ac.uk and mention the items concerned
queries about items missing from, or damaged in, the Home Practical Kit	write to S103 Home Kit Queries Department of Earth Sciences The Open University Walton Hall Milton Keynes MK7 6AA Tel. fax: 01908 654871 Email: S103-Home-Kit-Queries@open.ac.uk
queries about computer hardware and difficulties using course software	telephone OU Computing Helpdesk: 01908 653972 or email ou-computing-helpdesk@open.ac.uk or go to www.open.ac.uk/students/helpdesk Fax: 01908 652193, marked 'for attention of OU Computing Helpdesk' or write to LTS Student Computing Helpdesk The Open University Walton Hall Milton Keynes MK7 6AA
comments on the course itself (for example, suspected errors, suggestions for improvements)	write to: The S103 Course Manager Science Faculty The Open University Walton Hall Milton Keynes MK7 6AA or email: S103-course-team@open.ac.uk
queries about registration, withdrawal from the course, course results, change of name, course fees	See your *StudentHome* page or contact: The Registration and Fees Centre The Open University P.O. Box 197 Milton Keynes MK7 6BJ Tel.: 0870 333 4340 Email. REG-FEES@open.ac.uk
queries about fees, change of address, study centre facilities, withdrawal from the course	Student Services at your Regional Centre

7 Who produced S103?

S103 has been developed by the following large team of people drawn from many areas of the University.

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The Course Team would like to acknowledge the contributions of students and other people, too numerous to mention, who have tested and commented on various course components.

8 S103 Block authors

Brown, E., Freake, S., Metcalfe, J. and Rose, M. (1998) S103 *Discovering Science*. Block 1: *Water for life.* The Open University, Milton Keynes.

Blake, S., Dise, N., Jones, B., Murphy, P. and Taylor, P. (1998) S103 *Discovering Science*. Block 2: *A temperate Earth?* The Open University, Milton Keynes.

Blake, S., Bradshaw, K., Dise, N., Jones, B. and Smith, S. (1998) S103 *Discovering Science*. Block 3: *The Earth and its place in the Universe.* The Open University, Milton Keynes.

Halliday, T., Murphy, P. and Whatson, T. (1998) S103 *Discovering Science*. Block 4: *Unity within diversity.* The Open University, Milton Keynes.

Freake, S. and Grimes, D. (1998) S103 *Discovering Science*. Block 5: *Energy.* The Open University, Milton Keynes.

Johnson, D. (1998) S103 *Discovering Science*. Block 6: *Our world and its atoms.* The Open University, Milton Keynes.

Broadhurst, D., Lambourne, R.J. and Norton, A. (1998) S103 *Discovering Science*. Block 7: *The quantum world.* The Open University, Milton Keynes.

Johnson, D., Moore, E., Mortimer, M., Taylor, P. and Williams, R. (1998) S103 *Discovering Science*. Block 8: *Building with atoms.* The Open University, Milton Keynes.

Furth, A., Hall, M., Halliday, T., Metcalfe, J. and Walker, C. (1998) S103 *Discovering Science*. Block 9: *Continuity and change.* The Open University, Milton Keynes.

Bradshaw, K., McGarvie, D., Palmer, D., Rogers, N., Sheldon, P. and Webb, P. (1998) S103 *Discovering Science*. Block 10: *Earth and life through time.* The Open University, Milton Keynes.

Broadhurst, D. and Norton, A. (1998) S103 *Discovering Science*. Block 11: *Universal processes.* The Open University, Milton Keynes.

Jones, B., Ridge, I. and Wright, I. (1998) S103 *Discovering Science*. Block 12: *Life in the Universe.* The Open University, Milton Keynes.

Note: there is no course textbook to accompany Block 12. This block comprises the Study Guide, the Study File, the two booklets of articles for Block 12 and the booklet Supplementary Articles for Block 12.

Appendix General learning outcomes for S103 *Discovering science*

When you were considering taking S103, you probably read some text (in a booklet or on a web page) to find out 'what is in' S103. Indeed, we often think about courses in terms of their factual content, and whether that content interests us. However, a more complete way of looking at a course is to consider what the course *learning outcomes* are. Learning outcomes are simply statements that tell you what you should know and what you should be able to do (or do better) as a result of studying the course. Thus they go beyond specific topics you might study to include skills and techniques you develop as part of the course. The work we give you as part of the course and the assessment we set for you are opportunities for you to develop and demonstrate a range of general learning outcomes.

Learning outcomes are usually grouped under four headings. The learning outcomes listed under *Knowledge and understanding* are concerned with knowing about and understanding various topics, concepts and techniques. *Cognitive skills* are concerned with how you *apply* your knowledge and understanding, i.e. your skills of description, application, analysis and synthesis of knowledge. *Key skills* are concerned with developing your ability to 'do' various useful things (things which *all* science students are expected to develop), and are mostly focused on communication, computational and numeracy skills. The learning outcomes listed under *practical and/or professional skills* are concerned with the skills needed to do experimental science. Practical skills are developed to only a limited extent in S103. If you want to engage more fully with the practice of science, you should consider registering for SXR103 *Practising science* (see Section 4.12).

Knowledge and understanding

In the context of the topics covered in S103, you should be able to demonstrate knowledge and understanding of:

1 the terminology, nomenclature, classification systems, conventions and units used in biology, chemistry, Earth sciences and physics, appropriate to study at this level;

2 some of the underlying facts, concepts, principles and theories associated with the study of science;

3 methods of acquiring, interpreting and analysing scientific information;

4 the processes that shape the natural world at different time-scales and scales of size;

5 the benefits of a multidisciplinary and interdisciplinary approach in advancing scientific knowledge and understanding;

6 the contribution of science to informed debate about some aspects of environmental and social issues.

Cognitive skills

On completion of S103, you should also be able to:

1 make sense of information presented in a variety of ways, including text, tables, graphs, diagrams and figures, numerical and mathematical descriptions, and computer-based multimedia;

2 understand and make use of the facts, concepts, principles and theories relating to the main subject areas in science;

3 apply your knowledge and understanding of scientific concepts to address familiar and unfamiliar problems;
4 describe, analyse and interpret scientific information and data;
5 make links/connections and recognise associations/relationships among different subject areas;
6 understand the use of simple analogies and models in order to explain scientific concepts;
7 classify an appropriate range of organisms, objects and/or systems on the basis of similarities and differences

Key skills

On completion of S103, you should also be able to:

1 communicate scientific topics clearly and concisely, using methods appropriate to your purpose and audience;
2 use mathematical skills appropriate to the study of science at this level;
3 solve numerical problems using non-computer based methods;
4 process, interpret and present data using appropriate qualitative and quantitative techniques;
5 plan and implement efficiently, effective ways of working, so demonstrating time-management and organizational skills;
6 reflect on the experience of learning in order to develop more effective learning strategies.

Practical and/or professional skills

On completion of S103, you should also be able to:

1 handle materials safely by complying with safety instructions and being aware of any specific hazards associated with the use of the materials;
2 make and record appropriately, observations and measurements of a quantitative and qualitative nature;
3 consider issues of accuracy, precision and uncertainty in the recording and analysing of data;
4 interpret data derived from laboratory and field observations and measurements in terms of the appropriate underlying scientific theories.